ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 07, pp.34916-34923, July, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

INVESTIGATING THE ACCURACY OF THE MASS OF LOCALLY PACKED DAILY CONSUMPTION GOODS

***,[1]Sisay Milkias Waza and [2]Solomon Hailemariam Didu**

Department of Physics, College of Natural Sciences, Jimma University, Ethiopia

ARTICLE INFO

Article History:
Received 07th May, 2016
Received in revised form
26th June, 2016
Accepted 15th July, 2016
Published online 31st July, 2016

Key words:

Locally packed items,
One-Sample Test,
Mean Difference,
Accuracy,
Mass (1000 gm, 500 gm, 250 gm),
Coffee, Berbere,
Kolo, Shiro.

ABSTRACT

The ability to make accurate measurements is one of the essential foundations of an advanced industrial society. This ability is the pivot around which trade, commerce and society revolve. Everyday extremely large number and variety of items are in the selling buying process in our surroundings for a wide variety of purposes. The prices and important decisions are based on measurements. Bearing this in mind Ethiopia is one of the country in which the economy is growing at an alarming rate, thus the research was aimed on investigating the accuracy of the mass of selected locally packed daily consumption food items which are on market in the country, those were coffee, 'Berbere' /Powdered chili or Ethiopian Spice Blend/, 'Kolo' /The cherished Ethiopian Snack/ and 'Shiro' /Powdered Chickpeas or broad bean/, in which packages labeled 1000 gm, 500 gm and 250 gm were considered. The methodology used for the research was cross sectional method and a total of 455 locally packed items were collected from 377 shops randomly and the collected data's were measured in laboratory and One-Sample Test and the Mean Difference were computed using SPSS version 20 Software and the numerical results were displayed using tables and the results obtained were compared with the international standards. The overall findings of the study revealed that the locally packed items meets the standard. Accordingly, conclusions were drawn based up on the findings and recommendations were made from observations.

Citation: Sisay Milkias Waza and Solomon Hailemariam Didu, 2016. "Investigating the accuracy of the mass of locally packed daily consumption goods", *International Journal of Current Research*, 8, (07), 34916-34923.

INTRODUCTION

Metrology or the science of measurement is a discipline that plays an important role in sustaining modern societies. It deals not only with the measurements that we make in day-to-day living, but also in industry, science and technology as well as international trade. The technological advancement of the present-day world would not have been possible if not for the contribution made by metrologists all over the world to maintain accurate measurement systems. Without measurements and clearly defined measured variables trade and market are affected by controversies and disputes. In many cases legal regulations would not be applicable, production processes would neither be applicable nor controllable and progressive high technology in research and industrial institutions would not be possible. Hence, one has to understand that Measurement is a fundamental empirical procedure to receive information on properties and state of a physical quantity (Tilahun Tesfaye *et al*., 2011). The determination of large masses, however, is less accurate. The relative weighing uncertainty of 100 tones is approximately 10^{-4}. Very large masses such as astronomical bodies can only be determined by comparing them with similarly large bodies, whose mass cannot be directly determined either. Up to now, the most accurate determination of mass - in relation to the sun's mass - has been made with a relative uncertainty of 4 x 10^{-4} on a pulsar consisting of two neutron stars. The mass of the sun is about 10^{31} kg, and is only accurately known to approximately 10^{-3} to 10^{-4}, about the same degree of accuracy as the gravitational constant. The mass of a galaxy or even the entire universe is estimated on models. From the scientifically experimental viewpoint, the range of mass determination extends from the electron to the fixed star. For the range of directly accessible objects, scales are the measuring instrument used to determine mass - or rather to compare a known mass of a standard with the mass to be determined of a commodity or another standard. The structural shape of scales first changed radically in the 1970's. Today, electronic balances with load cells instead of beams or lever systems are widely used. These load cells are compact units that according to various physical

Corresponding author: Sisay Milkias Waza,
Department of Physics, College of Natural Sciences, Jimma University, Ethiopia.

principles transform the weight force produced into an electric signal. Basically, an electronic balance consists of weighing pans, an electrical indicating device, and a case containing the load cell and electronic components. Beam scales are still used today for maximum accuracy requirements: mass comparators and comparator balances. Besides the beam, these comparators have an electro-magnetic system for compensation and an indicating device giving a fraction of the total weight force. With a hybrid system of this kind, such comparators may have a resolution of about 10^{-10}. The present growth in the use of balances is partly due to the fact that increasingly more goods are being traded and priced according to their mass. In the past, besides mass the price of goods was also calculated according to other physical quantities such as volume, and also by the piece. In research and development too, analysis based on mass determination is becoming increasingly important. (Manfred Kochsiek and Michael Glaser (2000))

Statement of the Problem

Measurement theory is the study of how numbers are assigned to objects and phenomena, and its concerns include the kinds of things that can be measured, how different measures relate to each other, and the problem of error in the measurement process. Mass measurement is practiced widely both in industry and in trade and commerce. Mass is defined as the 'quantity of matter of an object'. However, the measurement of mass is mostly carried out by weighing, using a variety of balances (G.M.S. de Silva, 2002). In particular, the study was revolved around the identification and analysis of types of errors committed in measuring mass of locally packed daily consumption goods.

Thus, the questions addressed in the study were listed as follows.

(1) Do the mass of locally packed daily consumption commodities were accurate as the quantity of mass labeled on their package?
(2) Do the packages of locally packed items affect the mass contained in it?
(3) Was there any supervision for checking the accuracy of the mass of locally packed daily consumption goods?
(4) What affects the mass of locally packed foods items?
(5) How one can check the accuracy of the mass of locally packed items?

The Concept of Mass

The concept of mass in physics is even today subject to continual change. After the discovery that a distinction has to be made between inert and gravitational mass, and that in turn gravitational mass is either active or passive, the relativity theory showed that mass apparently increases when traveling at great speeds. The term mass was therefore restricted to rest mass and instead energy was extended by an additional momentum-dependent term. In atomic, nuclear and particle physics, the recognition that mass and energy are equivalent led to a recognized arrangement in which mass is given by the relation of energy E and the square of the speed of light C, that is, E/C^2 - since in the determination of the mass of an atomic particle, it is the energy which must be considered. The masses of classical bodies on the other hand are for the most part determined by means of gravitational interaction. Today however, classical Newtonian gravitation is frequently challenged, and attempts are being made to quantize gravitation and to describe it via a "quantum gravitation" together with the three other interactions (electromagnetic, strong and weak) in a uniform theory. Besides its original meaning as a physical quantity, the word mass also has other meanings certainly of older origin, for example the above-mentioned Latin massa. It is also used in the sense of matter, substrate, as in mass concrete and mass absorption coefficient. Another meaning relates to a large number of individual persons or things, as in the masses (ordinary people), mass production, mass grave, mass murder, mass tourism, mass media etc (Manfred Kochsiek and Michael Glaser (2000)).

Primary standard and SI units

The SI base unit for mass is the kilogram (kg), defined as the mass of the international prototype kilogram maintained at the Bureau des Poids et Mesure (BIPM) in Sevres, France. The kilogram remains the only artefact standard of the modern SI system of units. The primary standard of mass is also the international prototype kilogram, made from platinum iridium alloy. (G.M.S. de Silva, 2002)

Secondary and working standards

At the signing of the Treaty of the Metre, 48 copies of the kilogram were made and distributed to the 48 national laboratories of the member countries. These kilograms constitute the secondary standards of mass. Countries that joined the metre convention later were also given a copy of the kilogram. In addition national laboratories maintain a set of weights known as tertiary standards. These standards are used for the calibration of weights used in industry and trade and commerce, except in those circumstances where uncertainty of the weights requiring calibration demands a higher level standard to be used. (G.M.S. de Silva, 2002)

Mass and weight

Mass and weight are often confused as synonymous, though they are two distinctly different quantities. Mass is defined as the amount of matter in an object. It is also defined using Newton's second law of motion, namely

$$F = ma$$

Each object possesses a property called mass, which appears in the equation as the constant of proportionality between a force (F) applied to the object of mass (m) and the resulting acceleration (a) of the object. The weight of an object is the force experienced by it due to the earth's gravity. Since an object of mass (m) will accelerate through 'g', the acceleration due to gravity, we can write the above equation for motion under gravity:

$$W = mg$$

W is known as the weight of the object. Thus, the weight of an object would vary by a very small amount, as it moved about from place to place, on the surface of the earth, due to the variation of the value of ‘ g ’. Weight being a force should be measured in force units, in SI the unit is the newton (N). In the older metric systems of units, namely the centimeter - gram - second (CGS) and metre –kilogram - second (MKS) systems, the units ‘gram-weight’ and ‘kilogram-weight’ were used. However, a problem arose due to these units, defined as the force exerted by the earth’s gravity on a mass of one gram or one kilogram respectively, being dependent on the value of ‘ g ’, the gravitational acceleration. To overcome these difficulties, a unit for measurement of force known as the ‘kilogram-force’ was defined. The kilogramforce is the force experienced by a kilogram due to a standard acceleration of 9.806 55 m/s^2. In coherent SI units, these difficulties do not arise, as mass and force are measured using distinctly recognizable non-gravitational units, namely the kilogram and the newton. The newton is a derived unit of the SI, defined as the force required to accelerate a mass of one kilogram through 1 m/s^2. (G.M.S. de Silva, 2002)

Trade and measurement

From everyday purchases of bread, milk and petrol to multi-million dollar exchanges of minerals, energy and agricultural commodities, there are millions of consumer and business transactions in which the price paid is dependent on measures of quantity and/or quality (or product ‘grade’). By one estimate, the value of Australian business-to-business and retail transactions reliant on measurement could exceed $400 billion per year.

The use and verification of product measures in Australia is governed by trade measurement regulation. Its provisions cover:

- Approval and use of measuring instruments for trade (such as weighing scales, flow-meters, tanks and beverage dispensers);
- Licensing of measuring instrument servicing Organizations that have personnel nominated to certify measuring instruments;
- Packaging and labeling of pre-packaged articles;
- Sale of goods by measurement (of quantity or quality);
- licensing of operators of public weighbridges; and
- Inspection of trade measuring instruments and pre-packages, and penalties for breaches of the law.

Trade measurement regulation has primarily been the province of the States and Territories. Each jurisdiction enacted and administered its own trade measurement legislation and conducted its own enforcement and compliance programs. In 1990, the States and Territories (excluding Western Australia) agreed to adopt Uniform Trade Measurement Legislation (UTML), to address concerns about discrepancies in trade measurement and to ‘provide a high level of consistency of regulation between jurisdictions’. Despite the adoption of UTML, inconsistencies in approaches remained, and a number of reviews argued that there would be merit in a more nationally consistent approach to trade measurement regulation. (MCCA (Ministerial Council of Consumers Affairs) (2006))

Net Contents of Packaged Goods

Routine verification of the net contents of packages is an important part of any weights and measures program to facilitate value comparison and fair competition. Consumers have the right to expect packages to bear accurate net content information. Those manufacturers whose products are sold in such packages have the right to expect that their competitors will be required to adhere to the same standards. The procedures are recommended for use to verify the net quantity of contents of packages kept, offered, or exposed for sale, or sold by weight, measure (including volume, and dimensions) or count at any location (e.g., at the point-of-pack, in storage warehouses, retail stores, and wholesale outlets).

Packages at Point of Pack

Testing packages at the “point of pack” has an immediate impact on the packaging process. Usually, a large number of packages of a single product are available for testing at one place. This allows the inspector to verify that the packer is following current good packaging practices. Inspection at the point of pack also provides the opportunity to educate the packer about the legal requirements that products must meet and may permit resolution of any net content issues or other problems that arise during the testing. Point of pack testing is not always possible because packing locations can be in other States or countries. Work with other State, county, and city jurisdictions to encourage point of pack inspection on products manufactured in their geographic jurisdictions. Point of pack inspections cannot entirely replace testing at wholesale or retail outlets, because this type of inspection does not include imported products or the possible effects of product distribution and moisture loss at retail. At the point of pack, only examine the manufacturing process. Therefore an effective testing program will also test at wholesale and retail outlets.

Packages at Wholesale

Testing packages at a distribution warehouse is an alternative to testing at the production point with respect to being able to test large quantities and a variety of products. Wholesale testing is a very good way to monitor products imported from other countries and to follow up on products suspected of being underfilled based on consumer complaints or findings made during other inspections, including those done at retail outlets.

Packages at Retail

Testing packages at retail outlets evaluates the soundness of the manufacturing, distributing, and retailing processes of the widest variety of goods at a single location. It is an easily accessible, practical means for State, Country and City jurisdictions to monitor packaging procedures and to detect present or potential problems. Generally, retail package testing is not conducive to checking large quantities of individual products of any single production lot. Therefore, at the very least, follow-up inspections of a particular brand or lot code number at a number of retail and wholesale outlets, and ultimately at the point of pack, are extremely important aspects in any package-checking scheme. After the evaluation of an inspection lot is reached, the jurisdiction should consider what, if any, further investigation or follow-up is warranted. At the point of sale a large number of processes impinge on the quality or quantity of the product. Therefore, there are many possible reasons for an inspection lot being out of compliance. A shortage in weight or measure may result from mishandling the product in the store, or from the retailer's failure to rotate stock. Shortages may also be caused through mishandling by a distributor, or from failure of some part of the packaging process. Shortages may also be caused by moisture loss (desiccation) if the product is packaged in permeable media. Therefore, being able to determine the cause of an error in order to correct defects is more difficult when retail testing is used.

What products can be tested?

Any commodity sold by weight, measure, or count may be tested. The product to be tested may be chosen in several ways. The decision may be based on different factors, such as (1) marketplace surveys (e.g. jurisdiction-wide surveys of all soft drinks or breads), (2) surveys based on sales volume, or (3) audit testing to cover as large a product variety as possible at food, farm, drug, hardware stores, or specialty outlets, discount and department stores. Follow-up of possible problems detected in audit testing or in review of past performance tends to concentrate inspection resources on particular commodity types, brand names, retail or wholesale locations, or even particular neighborhoods. The expected benefits for the public must be balanced against the cost of testing. Expensive products should be tested because of their cost per unit. However, inexpensive items should also be tested because the overall cost to individual purchasers may be considerable over an extended period. Store packaged items, which are usually perishable and not subject to other official monitoring, should be routinely tested because they are offered for sale where they are packed. Products on sale and special products produced for local consumption should not be overlooked because these items sell quickly in large amounts. Regardless of where the test occurs, remember that it is the inspector's presence in the marketplace through routine unannounced testing that ensures equity and fair competition in the manufacturing and distribution process. Finally, always follow up on testing to ensure that the problems are corrected; otherwise, the initial testing may be ineffective.

Package Requirements

The net quantity of content statement must be "accurate," but reasonable variations are permitted. Variations in package contents may be a result of deviations in filling. The limits for acceptable variation are based on current good manufacturing practices in the weighing, measuring, and packaging process. The first requirement is that accuracy is applied to the average net contents of the packages in the lot. The second requirement is applied to negative errors in individual packages. These requirements apply simultaneously to the inspection of all lots of packages.

Inspection Lot

An "inspection lot" is defined as a collection of identically labeled (except for quantity or identity in the case of random packages) packages available for inspection at one time. The collection of packages will pass or fail as a whole based on the results of tests on a sample drawn from this collection.

Average Requirement

In general, the average net quantity of contents of packages in a lot must at least equal the net quantity of contents declared on the label. Plus or minus variations from the declared net weight, measure, or count are permitted when they are caused by unavoidable variations in weighing, measuring, or counting the contents of individual packages that occur in current good manufacturing practice. Such variations must not be permitted to the extent that the average of the quantities in the packages of a particular commodity or a lot of the commodity that is kept, offered, or exposed for sale, or sold, is below the stated quantity.

Individual Package Requirement

The variation of individual package contents from the labeled quantity must not be "unreasonably large." Also packages that are under filled by more than the Maximum Allowable Variation specified for the package are considered unreasonable errors. Unreasonable shortages are not generally permitted, even though overages in other packages in the same lot, shipment or delivery compensate for such shortage.

Maximum Allowable Variation

The limit of "reasonable variation" for an individual package is called a "Maximum Allowable Variation" (MAV). An MAV is a deviation from the labeled weight, measure, or count of an individual package beyond which the deficiency is considered to be unreasonable. Each sampling plan limits the number of negative package errors permitted to be greater than the MAV.

Deviations Caused by Moisture Loss or Gain

Deviations from the net quantity of contents caused by the loss or gain of moisture from the package are permitted when they are caused by ordinary and customary exposure to conditions that normally occur in good distribution practice and that unavoidably result in change of weight or measure. According to regulations adopted by the U.S. Some packaged products may lose or gain moisture and, therefore, lose or gain weight or volume after packaging. The amount of lost moisture depends upon the nature of the product, the packaging material, the length of time it is in distribution, environmental conditions, and other factors. Moisture loss may occur even when manufacturers follow good distribution practices. Loss of weight "due to exposure" may include solvent evaporation, not just loss of water. For loss or gain of moisture, apply the moisture allowances to the maximum allowable variations permitted for individual packages and to the average net quantity of contents before determining the conformance of a lot (Tom Coleman and Terry L. Grimes, 2002)

Average Quality System (AQS)

AQS is an internationally recognized system for determining deficiencies in packages sold by quantity. It can be used where goods are packed in set amounts, eg 1 kg bags of sugar or 1 liter of milk, and labeled as such. It is used in a number of other countries or economies including the European Union, Canada, the USA, South Africa and Japan. Australia is currently going through a consultation process and expects to adopt the system in the near future (Minister of Consumer Affairs, 2001).

Methodology

Study design

The research was quantitative in type and therefore quantitative design were implemented to meet the objectives of the project. The researchers measured the mass of locally packed daily consumption goods and analyzed quantitatively. The researchers used cross sectional method to collect data during the study period.

Study area

The study was conducted at Jimma city administration, Agaro, Seka, and Serbo towns of Jimma Zone.

Study population

The study population for the research were selected locally packed daily consumption food items those were coffee, 'Berbere' /Powdered chili or Ethiopian Spice Blend/, 'Shiro' / Powdered Chickpeas or broad bean/, and 'Kolo' /The cherished Ethiopian Snack/ which were on market in randomly selected shops of Jimma city administration, Agaro, Seka and Serbo towns of Jimma Zone. Locally packed items we mean items which are packed in homes or in small scale industries (cottage industries) but which are in the market. Locally packed daily consumption goods are available in every corner of the country and are distributed mostly from Addis Ababa (the capital of Ethiopia).

Sample size and sampling technique

The researchers employed both purposive and simple random sampling techniques. Purposive sampling was employed to bye commonly used food items in the community and random sampling was utilized to sample 377 shops from out of 21,031 shops.

The research instruments

Measuring mass of different items and Observation

The study focused on checking the accuracy of the mass of locally packed daily consumption goods; therefore, the mass of the samples was measured through a traced mass measuring device in the physics department of Jimma University besides this the researchers observed the type of packing material and the labels on each package and how it was packed.

Data collection procedures

Data's were collected by buying locally packed daily consumption goods from the randomly selected shops.

Data analysis

In this study descriptive statistical methods were employed to address the research question. Among the descriptive ones, tables and summary measures of the variables in interest were used. Accordingly, the data obtained through these methods were computed using SPSS 20.0.

Ethical considerations

All activities of the research were conducted through the official letter from Jimma University, administrative bodies of Jimma city administration and towns in Jimma Zone.

RESULTS AND DISCUSION

The purpose of net quantity verification is to ensure the accuracy of the net quantity information that is required to appear on packages by weights and measures laws and packaging and labeling regulations. The requirements are based on law and the test procedures are based on sound science and are reproducible and repeatable (8). In this research a total of 455 samples were measured and those were 27 packages of a 1000 gm (1Kg) labeled coffee, 2 packages of 1000 gm (1 Kg) labeled 'Kolo' /The cherished Ethiopian Snack/, 2 packages of 500 gm (1/2 Kg) labeled 'Shiro' / Powdered Chickpeas or broad bean/, 54 packages of 500 gm (1/2 Kg) labeled 'Kolo', 154 packages of 250 gm (1/4 Kg) labeled 'Shiro', 160 packages of 250 gm (1/4Kg) labeled 'Berbere' /Powdered chili or Ethiopian Spice Blend/, and 56 packages of 250 gm (1/4 Kg) labeled 'Kolo'. The researchers were proposed to use the same number of sample size for each packages to remove bias but the intended packages were not available on the market during the research period such as 500 gm (1/2 Kg) labeled package of coffee and 'Berbere', 250 gm (1/4 Kg) labeled coffee, 1000 gm (1 Kg) labeled 'Shiro' and 'Berbere'. Therefore the result of this research is based on the above datas'. Figure 1. Shows the mass of a 1 kg sample as measured by researchers in mass laboratory of Metrological institute of Ethiopia (NMI) for comparison (traceability)

Figure 3. Shows when researchers were measuring the mass of the samples in the lab.

The following are the SPSS output of the T - Test for the data's.

Table – 1 (a). One-Sample Statistics for 1000 gm Labeled coffee as measured in the laboratory

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
The mass of 1000 gm Labeled coffee as measured in the laboratory	29	1001.6207	10.26232	1.90567

Figure 1. The mass of a 1 kg sample as measured by researchers in mass laboratory of Metrological institute of Ethiopia (NMI) for comparison (traceability)

Figure 2. Some of the samples (locally packed food items) to be measured in the laboratory

Figure 3. When researchers were measuring the mass of the samples in the lab

Table – 1 (b). One-Sample Test for 1000 gm Labeled coffee as measured in the laboratory

One-Sample Test						
	Test Value = 1000					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
The mass of 1000 gm Labeled coffee as measured in the laboratory	.850	28	.402	1.62069	-2.2829	5.5243

Table – 1 (a) and (b) shows the output for 1000 gm (1/4 Kg) labeled coffee as measured in the laboratory. As we can see from the tables the sample size is 29, the sample mean values is 1001.6202 gm, the sample standard deviation is 10.26232, the standard error of the mean is 1.90567 and its P value is 0.201 which is greater than 0.050 (default level of significance) thus the researchers fail to reject the null hypothesis but according to the Weights and Measures Amendment Act 2000 (Minister of Consumer Affairs, 2001), package weights above 1 kg are acceptable and package weights falling within 985 gm - 1000 gm band are acceptable providing the sample passes the “average test”. Therefore our findings shows that the locally packed items labeled 1000 gm (1 Kg) coffee meets the standard.

Table – 2 (a). One-Sample Statistics for 500 gm Labeled Shiro & Kolo as measured in the laboratory

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
The mass of 500 gm Labeled Shiro & Kolo as measured in the laboratory	56	500.6429	6.99202	.93435

Table – 2 (b). One-Sample Test for 500 gm Labeled Shiro & Kolo as measured in the laboratory

One-Sample Test

	Test Value = 500					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
The mass of 500 gm Labeled Shiro & Kolo as measured in the laboratory	.688	55	.494	.64286	-1.2296	2.5153

Table – 2 (a) and (b) shows the output for 500 gm (1/2 Kg) labeled ‘Shiro’ and ‘Kolo’ as measured in the laboratory. We can see from the tables that the sample size is 56, the sample mean values is 500.6429 gm, the sample standard deviation is 6.99202, the standard error of the mean is 0.93435 and its P value is 0.492 which is greater than 0.050 thus the researchers fail to reject the null hypothesis but according to reference 8, the maximum allowed variation (MAVs) for package labeled by weight more than 426 gm - 489 gm is 19.9 gm but the variation obtained from our samples mean is 0.6429 gm which is very small compared to 19.9 besides this the mean value of our sample is greater than 500 gm therefore the locally packed items labeled 500 gm (1/2 Kg) ‘Shiro’ meets the standard.

Table – 3 (a). One-Sample Statistics for 250 gm Labeled Shiro as measured in the laboratory

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
The mass of 250 gm Labeled Shiro as measured in the laboratory	154	251.9026	4.90267	.39507

Table – 3 (b). One-Sample Test for 250 gm Labeled Shiro as measured in the laboratory

One-Sample Test

	Test Value = 250					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
The mass of 250 gm Labeled Shiro as measured in the laboratory	4.816	153	.000	1.90260	1.1221	2.6831

Table – 3 (a) and (b) shows the output for 250 gm (1/4 Kg) labeled ‘Shiro’ as measured in the laboratory. We can see from the tables that the sample size is 154, the sample mean values is 251.9026 gm, the sample standard deviation is 4.90267, the standard error of the mean is 0.39507 and its P value is 0.000 which is less than 0.050 thus the researchers reject the null hypothesis but according to reference 8, the maximum allowed variation (MAVs) for package labeled by weight more than 208 gm to 263 gm is 12.7 gm but the variation obtained from our samples mean is 1.9026 gm which is very small compared to 12.7 gm; besides this the mean value of our sample is greater than 250 therefore the locally packed items labeled 250 gm (1/4 Kg) ‘Shiro’ fits the standard.

Table – 4 (a). One-Sample Statistics for 250 gm Labeled Berbere as measured in the laboratory

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
The mass of 250 gm Labeled Berbere as measured in the laboratory	160	251.7375	5.90968	.46720

Table – 4 (b). One-Sample Test for 250 gm Labeled Berbere as measured in the laboratory

One-Sample Test

	Test Value = 250					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
The mass of 250 gm Labeled Berbere as measured in the laboratory	3.719	159	.000	1.73750	.8148	2.6602

Table – 4 (a) and (b) shows the output for 250 gm (1/4 Kg) labeled ‘Berbere’ as measured in the laboratory. We can see from the tables that the sample size is 160, the sample mean values is 251.7375 gm, the sample standard deviation is 5.90968 , the standard error of the mean is 0. 46720 and its P value is 0.000 which is less than 0.050 thus the researchers reject the null hypothesis but according to reference 8, the maximum allowed variation (MAVs) for package labeled by weight more than 208 gm to 263 gm is 12.7 gm but the variation obtained from our samples mean is 1.7375 gm which is very small compared to 12.7 gm; besides this the mean value of our sample is greater than 250 therefore the locally packed items labeled 250 gm (1/4 Kg) 'Berbere' fits the standard.

Table – 5 (a). One-Sample Statistics for 250 gm Labeled Berbere as measured in the laboratory

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
The mass of 250 gm Labeled Kolo as measured in the laboratory	56	250.0179	6.65921	.88987

Table – 5 (b). One-Sample Test for 250 gm Labeled Berbere as measured in the laboratory

One-Sample Test

	Test Value = 250					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
The mass of 250 gm Labeled Kolo as measured in the laboratory	.020	55	.984	.01786	-1.7655	1.8012

Table – 5 (a) and (b) shows the output for 250 gm (1/4 Kg) labeled 'Kolo' as measured in the laboratory. We can see from the tables that the sample size is 56, the sample mean values is 250.0179 gm, the sample standard deviation is 6.65921, the standard error of the mean is 0.88987 and its P value is 0.984 which is greater than 0.050 thus the researchers failed to reject the null hypothesis but according to reference 8, the maximum allowed variation (MAVs) for package labeled by weight more than 208 gm to 263 gm is 12.7 gm but the variation obtained from our samples mean is 0.0179 gm which is very small compared to 12.7 gm; besides this the mean value of our sample is greater than 250 therefore the locally packed items labeled 250 gm (1/4 Kg) 'Kolo' meets the standard.

Conclusion

The mass of an object depends on different factors such as humidity, temperature, atmospheric pressure and so on. But in our case their effect is negligible and therefore we ignored them. In our research the mass of locally packed items we mean it includes the packing material too in which its mass is negligible relative to the content in it. The net contents of packages is an important part of any weights and measures program to facilitate value comparison and fair competition. Consumers have the right to expect packages to bear accurate net content information. As we can see from the tables of SPSS output, the result obtained through this research shows that locally packed daily consumption goods such as 'Berbere'/Powdered chili or Ethiopian Spice Blend/, coffee, 'kolo'/The cherished Ethiopian Snack/ and 'Shiro'/ Powdered Chickpeas or broad bean/ which are labeled in 1000 gm, 500 gm and 250 gm meets the standard.

Recommendation

Hence it is an emerging market in the country; packaged items helps the community in saving their time from preparing it but the researchers observed from the package that there was only description of the type of the item and the ingredients in the packed food item. And also the researchers checked that there was no supervision on checking the accuracy of the mass of locally packed daily consumption goods and appropriateness of the packing material. The result of the finding compares only the mass of locally packed goods with the standard value. It tells nothing about expire date, whether the packages are well packed or not, whether they use appropriate packing material or not, etc. So from this study the following recommendation were originated.

1. There should be an authorize body to regulate it.

2. Packers and sellers of pre-packaged goods:

- Must make sure packages are correctly labeled.
- Must make sure packages contain the stated net quantity'
- Must have suitable and accurate measuring equipment.
- Should put shelf time /expire date/ on their products
- Must use appropriate packing material.

Acknowledgment

The researchers would like to thank Jimma University College of Natural Sciences Research and Post graduate office for their financial support and Department of Physics for their laboratory facilities

REFERENCES

David Sefcik September 25, 2013. Checking the Net Contents of Packaged Goods, Fundamentals of Package Checking. NIST (National Institute of standard and Technology) Handbook 133. US department of commerce.

G.M.S. de Silva 2002. Basic Metrology for ISO 9000 Certification. Butterworth-Heinemann Linacre House, A division of Reed Educational and Professional Publishing Ltd

Manfred Kochsiek and Michael Glaser 2000. Comprehensive Mass Metrology, WILEY-VCH Verlag Berlin GmbH, Berlin ISBN:3-527-29614-X

MCCA (Ministerial Council of Consumers Affairs) 2006. Trade Measurement Volume 2: Australia.

Minister of Consumer Affairs May 2001. The Average Quality System, Proposed Amendment to The weight and Measurement Regulation 1999, ISBN 0-478-24219-0., Wellington, New Zealand

Robert V. Determining Sample size for Research Activities, rejcie University of Minnesota, duluth and daryle w. morgan texas and m. university.

Tilahun Tesfaye , Gizaw Mengistu and Wondwosen Fisseha 2011. Fundamental Concepts of National Quality Infrastructure, Physikalisch – Technische Bundesanstalt Publisher, Germany.

Tom Coleman and Terry L. Grimes January 2002. Checking the Net Contents of Packaged Goods. Supersedes NIST Handbook 133, Third Edition, and Supplements 1,2,3, and 4. By. National Institute of Standards and Technology Office of Weights and Measures.

****