UTILIZATION OF SOME FUNCTIONAL FOODS FOR LOWERING BLOOD LIPIDS

By

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ABSTRACT

Increasing awareness in consumer towards health and quality of food has encouraged studies on the utilization of different nutritionally rich ingredients for production of health and high nutritional quality foods.

Therefore, some plant sources (e.g. barley, mustard, defatted mustard & flaxseed meal and flaxseed oil) were selected as a source of active healthy components to prepare functional prebiotic foods for lowering serum blood lipids. The plant sources were characterized by high amounts of some valuable functional components as protein and fat (mustard and flaxseed meal), total dietary fiber (flaxseed meal), β-glucan (hull-less barley), total phenolic and alpha linolenic acid as omega-3 (flaxseed oil). Functional biscuits were formulated by replacing either wheat flour in biscuit formula by different plant meals at 5, 10, 15, 20, 25 and 30% levels or shortening by flaxseed oil at 25, 50, 75 and 100% levels. Sensory evaluation revealed that biscuits samples with 10% defatted mustard meal (DMM), 15% mustard and flaxseed meals (MM & FM), 30% barley meal (BM) and 100% flaxseed oil (FO) were significantly acceptable as control. Farinograph and extensograph measurements of biscuits dough were significantly affected by adding different plant sources. Biscuits made with 10% DMM and 15% MM contained 1.37 and 1.25 times more protein than the control. Biscuits supplemented with 30% BM and 15% FM contained 2.84 and 3.31 times more of total dietary fibers, respectively than the control. β-glucan content of BM-biscuits was 1.82%. Flaxseed oil-biscuits are practically rich in alpha linolenic acid, an omega-3 (42.76%) and it contains a less amount of linoleic acid, an omega-6 (13.52%). These means that fatty acids profile of biscuits can be improved by its supplementation with flaxseed meal or oil.

Different plant sources at 3, 5 and 7% levels were used for production of nutritional improved kareish-like cheese. Functional Kareish-like cheese containing 3% of barley and mustard meal exhibited significantly the best acceptable values regarding to their sensory physico-chemical and microbiological analysis. However, cold storage for two weeks significantly improved the overall acceptability of cheese made with different plant sources.

The biological evaluation of hypercholesterolemic rats fed on diets supplemented with different functional prebiotic biscuits revealed that consumption of diets containing barley and flaxseed meal and flaxseed oil biscuits for 8 weeks significantly ($p \leq 0.05$) reduced serum total cholesterol (TC), triglycerides (TG), Low density lipoproteins (LDL-c), very low density lipoproteins (VLDL-c) and ratios of TC/HDL-c, LDL/HDL-c, Atherogenic index (AI), and increased high density lipoprotein (HDL-c) or HDL-c/TC (HTR%). Also, consumption of diets based on biscuits prepared from different plant sources did not have deleterious effects on the liver and kidney functions, whereas the levels of serum aspartate amino-transferase (AST), alanine amino-transferase (ALT), alkaline phosphotase (ALP), urea, blood nitrogen urea (BUN), creatinine and protein were in the normal range. In addition, rats fed high-fat high-cholesterol diet resulted in severe damage to the liver, heart and kidney tissues, whereas, feeding of diets containing flaxseed oil, flaxseed and barley meals to the hypercholesterolemic rats lowered the degree of lesions of the liver. Thus, it could be concluded that flaxseed oil, flaxseed or barley meal based bakery products could be developed as a useful therapy for hyperlipidemia in developing countries like Egypt.

Key words

Functional prebiotic foods, biscuits, barley meal, mustard meal, defatted mustard meal, flaxseed meal, flaxseed oil, dietary fiber, β-glucan, omega-3, omega-6, farinograph, extensograph, kareish-like cheese,

microbiology, sensory evaluation, hypercholesterolemic, TC, TG, LDL-c, VLDL-c, HDL-c, TC/HDL-c, LDL/HDL-c, HTR%, AI, AST, ALT, ALP, urea, BUN, creatinine, liver, heart, kidney.

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ARABIC SUMMARY...

LIST OF ABBREVIATION

α-	Alpha
β-	Beta
ω-3	omega-3 fatty acids
ω-6	omega-6 fatty acids
-ve	Negative control
+ve	Positive control
∆ E	Change in color
a*	Redness
AACC	American Association of Cereal Chemists
AV	Acid value
AI	Atherogenic index
ALA	Alpha- linolenic acid
ALP	Alkalin phosphatase
ALT	Alanine amino transferase
AOAC	Association of Official Analytical Chemists
AOAS	American of Chemists' Society
AST	Aspertate amino transerase
b*	yellowness
B.U	Brabender unit
BC	Before Centenary
BHT	Butylated hydroxytoluene
C12:0	Lauric acid
C12:1	Laurolelic acid
C14:0	Myristic acid
C16:0	Palmitic acid
C16:1	Plmitoleic acid
C18:0	Stearic acid
C18:1	Oleic acid
C18:2	Linoleic acid

C18:3	Alpha Linolenic acid
C20:4	Arachodonic acid
C22:1	Erucic acid
C8:0	Caprylic acid
cal	Calorie
CFU	Colony Forming unit
CHD	Coronary heart disease
CVD	Cardiovascular disease
D	Diameter
DAC	Direct acidified cheese
DFE	Dietary folate equivalents
DHA	Docosahexanoic acid
DRIs	Dietary Reference Intakes
E	Optical density
e.g	Exampli gratia (for example)
Ed	Editor
EPA	Eicosapentanoic acid
et al.	And others
etc	et cetera
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
FO	Flaxseed oil
GAE	Gallic acid equivalent
GOT	Glutamate oxaloacetate amino transferase
GPT	Glutamate pyruvate amino transferase
HDL	High density lipoproteins
i.e	That is (id est)
ID	Iodine value
IDF	Insoluble dietary fibers
InSDF	Insoluble dietary fibers
ISO	International Standardrization Organization
IU	International unit